

Components of a Quality Acoustics Program Process



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OSW Policy Memos

- 2000.03 Mandates use of WinRiver
- **2002.01** Configuration of RDI ADCP's
- 2002.02 Policy on ADCP Qm's
- **2002.03** Release of WinRiver 10.03
- **2003.01** Discharges computed using SonTek RiverSurveyor
- **2003.04** Release of WinRiver 10.05
- **2004.xx** Release of WinRiver 10.06
- 2004.xx Calibration of ADCP's used for Discharge Meas.
- 2004.xx Guidance on the use of FlowTrackers

12/7/2001 ADCP Coordination and Support



Configuration of RDI ADCP's OSW 2002.01

Table 2.—Minimum Recommended Depth Cell Sizes, Maximum Profiling Ranges, and Maximum Relative Velocities for RDI ADCP's.

Water Mode	1200 kHz	600 kHz	300 kHz	Remarks
Minimun	n Recommen	ded Depth C	Cell Sizes, in	centimeters
1	25	50	100	
5	5	10	20	
8	5	10	20	
M	aximum Proj	filing Range	s, in meters	(feet)
1	20 (66)	60 <i>(197)</i>	130 (426)	Nominal range
5	4 (13)	8 (26)	16 <i>(53)</i>	Maximum range
8	4 (13)	8 (26)	16 <i>(53)</i>	Maximum range
Maxim	um Relative	Velocities, i	n meters/sec	: (feet/sec)
1	10 (32.8)	10 (32.8)	10 (32.8)	
5	0.5 (1.64)	1.0 (3.28)	1.0 (3.28)	
8	2 (6.56)	2 (6.56)	2 (6.56)	

Table 3.—Recommended Blanking Distances for RDI ADCP's.

	Blanking distance, in centimeters, by frequency									
ADCP Type	1200 kHz	600 kHz	300 kHz							
Broadband	50	50	100							
Rio Grande	25	25	75							



- Measure and record ADCP depth prior to each measurement.
 Make sure pitch/roll are similar to those during the actual Qm.
- Minimum of 4 transects per measurement, 2 pairs of reciprocal courses – (also for use

of GPS)

File Name	# Ens.	Start Time	Total Q	Start Bank	Left Dist.	Left Ens#	Left Q
			[ft³/s]		[ft]		[ft³/s]
KY06031r.000	666	12:07:18	752.066	Right	8.00	1265	2.309
KY06032r.000	836	12:18:03	768.374	Left	10.00	1335	1.310
KY06033r.000	668	12:30:42	767.332	Right	10.00	2868	-0.741
KY06034r.000	816	12:40:57	747.227	Left	10.00	2903	-2.471
Average	747		758.750				0.102
Std. Dev.	92		10.704				2.134
Std./ Avg.	0.12		0.01				21.00



If the discharge for any of the 4 transects differs from the measured discharge by more than 5 percent, a minimum of 4 more transects will be obtained and the measured discharge will be the average of all 8 transects.

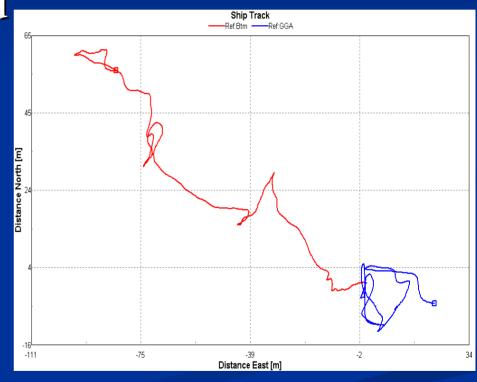
🔛 Discharge His	tory Tabular						
File Name	#Ens.	Start Time	Total Q	Start Bank	Left Dist.	Left Ens#	Left Q
			[ft³/s]		[ft]		[ft³/s]
MARS270r.000	910	11:27:17	5806.111	Right	26.00	6887	21.127
MARS271r.000	806	11:35:06	5966.820	Left	26.00	6921	15.861
MARS272r.000	838	11:44:27	5890.810	Right	25.00	8958	20.641
MARS273r.000	737	11:51:38	6136.663	Left	25.00	9004	17.249
MARS274r.000	799	12:43:36	7765.537	Right	25.00	933	28.403
Average	818		6313.188				20.656
Std. Dev.	63		820.972				4.869
Std./ Avg.	80.0		0.13				0.24
-I							



- If flow is highly unsteady, single transects may be used in the rating development – measurement pairs are preferred.
- Pairs of reciprocal transects should be made, whenever possible, in order to reduce directional biases.
- Select sites using guidelines in WSP 2175.



- Moving bed test should be made for every Qm.
 - Select a position(s)
 where the potential for bed movement is greatest
 - Hold position and collect data for 10 min.
 (5 min. minimum.)





Record and document moving bed tests

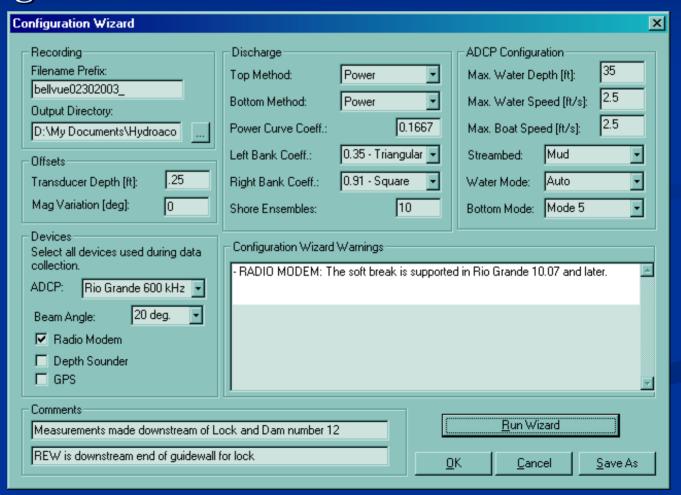
Proi	iler S/N <u>: 1129</u> j	Mfgr: RDI	Freq. 1200 Firs	mware: <u>10</u>	.14 SoftwareVer. 10.06
D_{ϵ}	epthCellSize	25 cm	Other commands:		Profiler Depth 0.3 feet
N	o. of Cells	15			Config file Mars023003.wrc
B1	anking Distance	25 cm			Deployment Mars023003
W	ater Mode	1			Moving Bed Mars023003_001r
Aı	mbiguity <u>Vel</u> .	170 cm/s			Moving Bed Present: Y N
W	ater pings	1			Diag. Test 1129082903.tst
В	ottom pings	11			Diag. Test Errors: Y N

Districts can demonstrate that moving bed tests are not necessary but they <u>must document it</u> by making moving bed tests for the range of flows.



Release of WinRiver 10.03 OSW Memo 2002.03

Configuration Wizard





Release of WinRiver 10.03 OSW Memo 2002.03

Describes use of thresholds for screening data

Configuration Settings	×
	Properties 1 Chart Properties 2 Resets charge Edge Estimates DS/GPS
Speed Of Sound Use ADCP Value Calculate For Each Ping Use Salinity [ppt]: Fixed Use Value [ft/s]: Projection Angle (F2-Current) Projection Angle [deg]:	Crossectional Area C Perpendicular to Mean Flow C Perpendicular to Proj. Angle Parallel to Average Course Data Screening Mark Below Bottom "Bad" Use 3 Beam Solution For BT Use 3 Beam Solution For WT Screen Depth
Backscatter Near-Zone Distance [ft]: 6.89 Calculate For Each Ping Use Fixed Values: Int. Scale [dB/cts]: 0.43 Absorption [dB/ft]: 0.04	Thresholds BT Error Vel. [ft/s] 0.33 WT Error Vel. [ft/s] 4.92 BT Up Vel. [ft/s] 32.81 WT Up Vel. [ft/s] 32.81 Fish Intensity [count] 50
	OK Cancel Apply



SonTek RiverSurveyor Discharges OSW Memo 2003.01

- Negative bias in discharge measurements processed with RiverSurveyor versions < 3.4
 - ADCP depth not included in edge estimates
 - Possible improper discharge computation when using GPS as a reference in versions 3.1 or less
- All discharge measurements should be reprocessed with RiverSurveyor 3.4 or greater.





Release of WinRiver 10.05 OSW Memo 2003.04

- RDI users should use WinRiver 10.05
- Use the file-locking feature after 'finalizing' measurements.





Release of WinRiver 10.05 OSW Memo 2003.04

 Use of the Discharge Measurement Wizard (DMW) is mandatory. Station No.: 04235600 Meas, No: 75
Station Name: Seneca River (Erie Canal) nr Port Byron, NY Date: 07/30/2003

 Party.
 hjz & mjw
 Width:
 282 ft
 Processed by: hjz

 Boat/Motor:
 Boston & electrolling
 Area:
 3,240 ft²
 Mean Velocity: 1.26 ft/s

 Gage Height:
 74.59 ft
 G.H.Change: 0.00
 Discharge:
 4,090 ft²/s

 Area Method:
 Avg. Course
 ADCP Depth: 0.66 ft
 Index Vel.:
 1.40 ft/s
 Rating No.:1

 Nav. Method:
 Bottom Track
 Shore Ens.:
 10
 Adj.Mean Vel: 1.27 ft/s
 Qm RatingG

 MagVar Method:
 None (0.0°)
 Top Est:
 Power (0.1667)
 Rated Area:
 3,210 ft²
 % Diff: 0.0%

 Depth Sounder:
 Not Used
 Bottom Est:
 Power (0.1667)
 Control:
 Clear

Screening Thresholds: ADCP: Max Vel: 2.82 ft/s BT 3-Beam Solution: ON Type/Freq.: Rio Grande / 600 kHz WT 3-Beam Solution: OFF Max. Depth: 16.5 ft Serial # 2352 Firmware: 10.14 BT Error Vel $0.33 \, \mathrm{ft/s}$ Mean Depth: 11.5 ft Bin Size: 10 cm. Blank: 25 cm WT Error Vel: $0.50 \, \rm{ft/s}$ % Meas : 77.99 % BT Mode: 5 BT Pinas: 1 BT Up Vel: 1.00 ft/s Water Temp.: 74.3 °F WT Mode:5 WT Pinas: 1 WT Up Vel.: ADCP Temp.: 74.3 °F 2.00 ft/s

Eilename Prefix: Weed

10.06.00

Software:

Diag. Test: 2352.030730090033.txt Moving Bed Test: Weed434r.000

Compass Test:

Meas. Location: approx. 300 ft downstream of gage

F	r.#		Edg	e D.	#Ens			Dischar	ge			Width	Area	Tin	ne	Mear	Vel.	%В	ad	
Ľ	1.11		L	R	#LIIS	Тор	Middle	Bottom	Left	Right	Total	vviutn	Area	Start	End	Boat	Water	Ens.	Bins	l
43	5	L	35	40	357	504	3211	248	68.1	93.3	4125	288	3339	09:10	09:13	1.17	1.24	0	6	#
43	16	R	25	50	499	507	3220	251	18.2	145	4142	280	3187	09:14	09:19	0.79	1.30	1	6	#
43	17	L	30	30	318	499	3210	253	28.4	86.7	4076	275	3330	09:19	09:22	1.31	1.22	1	5	#
43	18	R	35	40	422	502	3198	255	49.0	90.0	4094	280	3163	09:23	09:27	0.97	1.29	1	9	
43	19	L	35	40	412	494	3130	254	57.5	102	4038	283	3234	09:27	09:31	1.00	1.25	0	9	#
44	0	R	30	50	428	499	3177	248	50.4	101	4075	286	3206	09:32	09:36	0.94	1.27	1	5	#
M	eaı	ı	32	42	406	501	3191	252	45.3	103	4091	282	3243	Total	00:25	1.03	1.26	1	6	
SI)eı	,	4	8	63	4.65	33.2	3.12	18.6	21.4	37.4	5	75			0.19	0.03			
R/	M:	6	32	48	44.6	2.6	2.8	3.1	110.1	56.5	2.5	4.7	5.4			51.02	5.97			ĺ

Remarks:



Release of WinRiver 10.05 OSW Memo 2003.04

- Use the Config. Wizard (available since 10.03) for every Qm. If user over-rides CW commands with user commands, the rationale must be documented on measurement note sheet.
- Never set bottom discharge extrapolation method to "Constant".

nfiguration Wizard				>
Recording Filename Prefix: bellvue02302003_ Output Directory: D:\My Documents\Hydroaco Offsets Transducer Depth [ft]: .25 Mag Variation [deg]: 0 Devices Select all devices used during data collection. ADCP: Rio Grande 600 kHz Beam Angle: 20 deg. Radio Modem Depth Sounder GPS	Discharge Top Method: Bottom Method: Power Curve Coeff.: Left Bank Coeff.: Right Bank Coeff.: Shore Ensembles: Configuration Wizard - RADIO MODEM: T	Power O.1667 O.35 - Triangular O.91 - Square 10 Warnings he soft break is supported	ADCP Configur Max. Water De Max. Water Sp Max. Boat Spe Streambed: Water Mode: Bottom Mode:	pepth [ft]: 35 peed [ft/s]: 2.5 ped [ft/s]: 2.5 Mud
Comments Measurements made downstream of I	Lock and Dam number 1	2	<u>B</u> un Wi	zard



Release of WinRiver 10.06 OSW Memo 2004.xx

- Fixes serial communication problems introduced in WinRiver 10.05.
- Policies outlined in OSW Memo 2003.04 are the same.
- Not necessary to re-process data files collected with ver. 10.05.



Example of Completed 9-275-I

Transect Number	9-275-I 05/10/2001 Sta. No. <u>05543500</u> Sta. Name <u>Illinois F</u> Date <u>Feb. 30</u> ,	River near S	omewhere, IL	Survey es Division e Measurem	Processed by JDS ent Notes Ck'd by SDJ	
7	Width 282 Ar Profiler Water Temp.	ea <u>3,240</u> 15 °C at <u>1</u>	Vel 1.26 G 2:35 Rated area:	H 4.59	Disch 4,090 Index Velocity 1.40 4 Software Ver. 10.06	TEST
3 4 5 6 7	DepthCellSize No. of Cells Blanking Distance Water Mode Ambiguity Vel. Water pings Bottom pings	25 cm 15 25 cm 1 170 cm/s	Other commands:		Profiler Depth	ested)
Notes:			-0.7 4) 2.1 Avg	Sample biologi Measur	Comp. Cal.: Mars023003 cc.txt es collected: water quality, sediment, cal, other: rements documented on other sheets: quality, aux./base gage, other:	

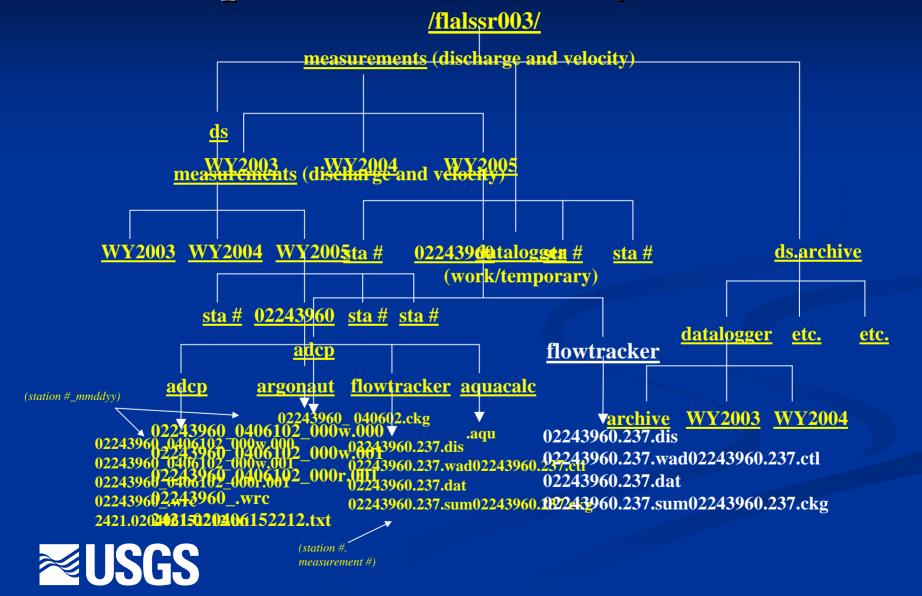


Quality Hydroacoustics Program – Data Transfer and Storage

- Transfer data from laptop to office file server
 - Complete transfer within 48 hours of return from field
 - Don't wait to transfer
 - Data maybe overwritten with final processed data
- Ethernet card and office LAN is easiest way to transfer files routinely —can use Zip disks, Flash cards, Jump drives, etc.
- Store data in proper directories (rawdata, self-tests....)



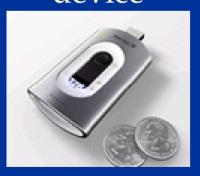
Example Data Directory Structure



Temporary Backups

Make temporary backups in the field – probably on a daily basis. Suggestions include:

USB Storage device



CD-R





Zip Drive/Disk

Flashdisk (PCMCIA card)





Quality Hydroacoustics Program – Review and Playback

- Review data in WinRiver (Playback mode)
 - Identify problems, such as ambiguity errors, bad ensembles, etc.
 - If necessary, correct edge distances, ADCP depth, shore pings, or adjust extrapolation method
- Save a discharge measurement summary for your records
- Have someone periodically review your measurements



Outline for Review of ADCP Data

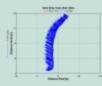
Outline for Review of WinRiver Data Files

1. Load Data

 Load rawdata file and play to end (Hit End key)

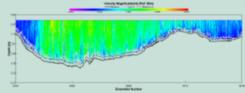
2. Check Ship Stick Plots

- · Look at ship stick plot
- · Verify velocity reference (BT or GGA)
- Step through depths using 1 (if problems are observed, look at velocity contour plots or intensity / back scatter plots)



3. Velocity Magnitude Contour

 Review velocity magnitude contour. Scale as appropriate. Look for bad or missing data, bed contour, lost ensembles, etc.)



4. Composite Tabular.—Review:

- Number of Ensembles (total) vs:
 - (1) Bad ensembles
 - (2) Lost ensembles
- · What is value for % Bad bins?
- Is water temperature realistic?
- Do the edge discharges appear reasonable?
- Do edge discharges have correct signs?



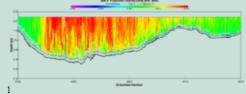
5. System Parameters

- · Hit F9 to check system parameters
- Does the info there (Frequency, Firmware, Water and Bottom modes, Cell Size) match the direct commands (F3) specified in the config file?
- · Does it match the field sheet?



6. Projected Velocity Contour Plot

 Hit F2 to set angle for projected velocity contour plot and verify that value for the angle is correct.
 "Freeze" that value (for the first





11/19/2003

Quality Hydroacoustics Program – Archival of ADCP Data

- Does the District have a written procedure for processing and archiving ADCP data?
 - ADCP measurement data:
 - Should be stored on a District server accessible to all who use/collect ADCP data
 - Should NOT be stored on laptops
 - Should be routinely backed up
 - Should be periodically archived to CD or DVD's
- An OSW memo is being prepared on this topic



Quality Hydroacoustics Program – Training

- Have users been trained by USGS?
 - Streamflow Measurements using ADCP's
 - Advanced ADCP Applications
 - Index Velocity Records Computation
 - **■** Refresher Class
- If training is more than 2 years old, how are users keeping up to date?
 - Do they subscribe to the acoustics mailing list?
 - Have they attended a recent Hydroacoustics Workshop?



Quality Hydroacoustics Program – Other

- Does the District seek outside review or assistance from OSW with ADCP measurements?
- Are measurement notes complete and are there notes about field conditions?



Quality Hydroacoustics Program – DPGS / Self Tests

- For any District that uses GPS
 - Does the District do compass calibrations for each measurement?
 - Are the compass calibrations logged and stored with the measurement info?
 - On-site magnetic variation determinations?
- Users should run (and log) an internal selftest for every measurement (absolute minimum of once per day).



ADCP Qm Review Form

,	General District ADCP Quality Assurance Practices
	fice: Reviewer:
	te of review:
1.	ADCP Measurements Data Storage and archival
	Does the District have a written data storage and archival plan? (yes no)
	Is the plan being used? (yes no)
	Are data stored on a server or desktop machine that is routinely backed up? (yes no)
	Are ADCP data periodically archived to CD or DVD? (yes no)
	Are ADCP Qm's locked (when using WinRiver 10.05) after record is finalized? (yes no)
	Is the Discharge Measurement Wizard being used in WinRiver? (yes no) Comments:
2.	ADCP Measurements QA Practices
	Are ADCP measurements reviewed? (yes no) If so, by whom? (ADCP Specialist trained user untrained District user trained out-of-District user)
	Does the District make periodic comparisons to Price AA or discharges from a stable rating site? (Not mandatory but encouraged) (yes no)
	Does office have a QA Plan? (yes no)
	Are external reviews done frequently? (yes no)
	Is there documentation on how/where? (yes no)
	Comments:
3.	ADCP Measurement Equipment
	Is proper boat(s) used (stability, size, etc)?
	Proper boat engine? (speed and low-speed capability)
	Proper ADCP mount? (adjustable, location, sturdy, etc.)
	Is proper boat(s) used (stability, size, etc)? Proper boat engine? (speed and low-speed capability)

ADCP Training Have users received ADCP training from OSW? (yes no) Does the District have any in-house mechanism for keeping users up-to-date? (yes no) If so, please describe: Are users subscribed to the acoustics mailing list? (yes no) To subscribe, users should go to http://hydroacoustics.usgs.gov/ and click on the "subscribe" link for the acoustics mailing list for latest information on ADCP's and OSW policie (yes no) For users who received training more than 2 years ago, have they attended OSW refresher class? (yes no) Regional workshop with hydroacoustics update? (yes no) OSW Hydroacoustics Workshop? (yes no) Please solicit input of hydroacoustics training needs and other hydroacoustics support-relaineeds.	Po	wer supply adequate for boat/ADCP/computer?
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needs.	Fc	OSW refresher class? (yes no) Regional workshop with hydroacoustics update? (yes no)
nmary/Additional Comments:		
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	-nn	nary/Additional Comments:
	_	·



Future Activities

- Web/CD tutorials on reviewing data for ADCP's/ADP's/ADVM's, etc.
- Automated QA/QC of ADCP measurements
 - both during and after Qm's.
- Goodness-of-fit algorithms for extrapolation of velocity profiles
- What is the implication of non-standard profiles on AA/Pygmy current meter Qm's?



New Instruments and QA/QC

What is OSW responsibility?

What is District Management/Specialist responsibility?

What is user responsibility?



USGS Hydroacoustics Workshop





Acoustics Web Pages

http://hydroacoustics.usgs.gov/

ADCP Mailing List

acoustics@simon.er.usgs.gov

